SOME ASPECTS OF THE MODIFICATIONS OF THE AQUATIC OLIGOCHAETA FAUNA IN THE CRIŞURI RIVERS BETWEEN 1994-1998

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Abstract

The aquatic oligochaeta were studied in the Crişuri Rivers between 1994-1998 in two research campaigns. In this paper we compare the results of the two campaigns and we apreciate the evolution of the oligochaeta fauna from the Crişuri Rivers according to the environmental modifications.

We observed that in the most river parts the number of the species decreased and sometimes their density increased. This fact is probably due to the higher organic pollution of the river portions in certain periods of time.

Keywords: oligochaeta, benthic fauna, diversity.

Introduction

The composition of the living organism communities in a certain environment reflects the quality of this environment. The changes in the species association reflect natural or anthropic modifications in the environment, modifications which determine the settlement or the disappearance of certain species.

The effects of the modifications can be short like oxigen depletion or longer like heavy metal pollution, and they determine injuries of the zoocoenoses, which will resettle in a longer time (A. Szitó, K. Mózes, 1997).

We tried to compare the aquatic oligochaeta fauna from the Crişuri rivers in the different years of study as follows: Crişul Alb 1994, 1997, 1998; Crişul Negru 1994, 1996, 1997, 1998 and Crişul Repede 1995, 1996, 1997, 1998. The material from 1994 and 1995 was collected by a campaign organised by Tisza Klub (Szolnok, Hungary) and Liga Pro Europa (Târgu Mureş, Romania). The results of this campaign were published in the Tiscia Monograph Series, The Criş/ Körös Rivers' Valleys, 1997. The material from 1996-1998 was collected by myself.

The sampling sites in the two campaigns were not all the same, so we compared the oligochaeta fauna from the matching sites on each river.

These were the follows: Crişul Alb: Brad, Aciuţa, Chişineu-Criş; Crişul Negru: Ştei, Tinca, Zerind; Crişul Repede: Şaula, Ciucea, Stâna de Vale, Vadu Crişului,

Aleşd, Fughiu. The sample sites were described in a previous paper (A. Sárkány-Kiss, N. Găldean, N. Mihăilescu, 1997).

The goals were to apreciate the modifications of the aquatic oligohaeta community in the years of study, to appreciate the effects of the environmental changes on the aquatic oligochaeta and to forecast the future evolution of the aquatic oligochaeta community.

Material and methods

The samples were taken by a hand net with 250 μm pore mesh size. The sediment was collected near the banks on the right and left sides and in the main current.

Each sample was washed through a metal screen with a pore mesh size of 250 μm after collection and preserved in 3-4% formalin solution. The oligochaeta were separated from the sediment under a stereomicroscope with a four to sixfold magnification. Animals were preserved in 80% ethylalcohol.

For the taxonomical identification the following works were used: Brinkhurst 1963; Brinkhurst and Jamieson 1971; Ferencz 1979; Pop V. 1943, 1950.

Results

Crişul Alb River

At Brad in 1994 the number of species and the density of the oligochaeta was bigger than in the following years when we found two species (7 in 1994) and a density under 1000 ind./m^2. We found almost exclusively Tubificidae species. *Limnodrilus claparedeianus* and *Potamothrix isochaetus* were dominant. Only in 1997 we found one Naidid species: *Spercaria josinae*.

At Aciuţa we also found in 1997-1998 fewer species (1-2) than were found in 1994, but the density of the individuals is closer in the three years of study (Table 1). Dominant in 1997-1998 was *Limnodrilus claparedeianus* and in 1994 *Limnodrilus hoffmeisteri*.

At Chişineu-Criş in 1997 and 1998 we did not find any of the species found in 1994, but the density and the number of species were very alike in these years.

The number of species founded along the total number of sample sites of the Crişul Alb River (5 sites in 1994 and 12 in 1997-1998) were 11 in 1994 and 14 in 1997-1998, from which 5 species are common in the whole period of study: *Nais behningi, Nais pseudoptusa, Pristina rosea, P. bilobata, Limnodrilus claparedeianus*.

The diversity is the highest in 1994 in all three sample sites (Fig. 1). In the next period the diversity drops in all sample sites and in 1998 at Aciuţa it is zero, as well as in 1997 at Chişineu-Criş.

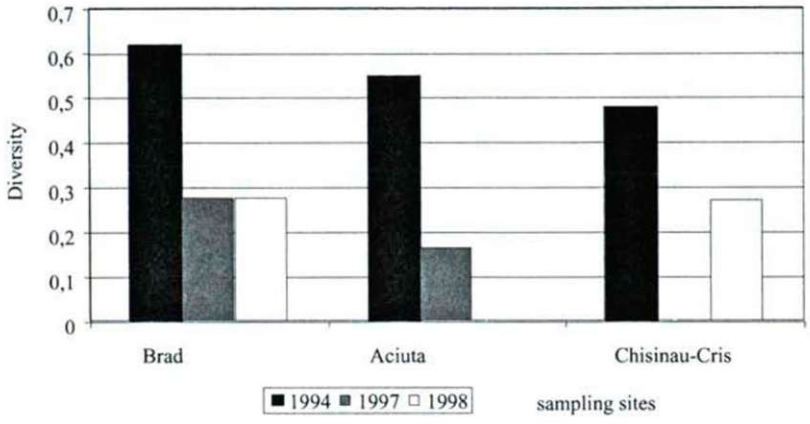

Fig.1. Comparative diversity of the oligochaeta fauna in the Crişul Alb River as a living resource in 1994, 1997, 1998. (Shannon-Wiener div. Index)

Crişul Negru River

At Ştei in 1994 the highest density and number of species (2809 ind./m^2 and 6 species) was found (Table 2). The situation was similar in 1996 when we also found 6 species and their density was around 2300 ind./m^2. In 1997 and 1998 the density and the number of species decreased very much as compared to the previous years situation, to 3 species and a density below 1500 ind./m^2.

At Tinca there is the only site along the river where in 1994 only one species *Branchiura sowerbyi* was found, but in the following years we found 4 to 7 species with a high density of the individuals, above 4500 ind./m^2.

At Zerind the number of species and the density of the aquatic oligochaeta were very similar in all the studied years, although the found species weren't the same ones in these years.

The number of species founded along the total number of sampling sites on the Crişul Negru River (9 sites in 1994 and 8 sites between 1996-98) were 16 in 1994 and 13 between 1996-98. The common species in these years are 8: *Nais behningi, N. bretscheri, Pristina aequiseta, P. bilobata, Vejdovskyella comata, Branchiura sowerbyi, Limnodrilus claparedeianus, Tubifex newaensis.*

The diversity in the compared sample sites varies in the 4 years of study. At Ştei the highest diversity was in 1994 (Fig. 2), in 1996 the diversity was almost the same as in 1994, but in 1997 it drops to 0,142 and in 1998 increases again.

At Tinca in 1994 the diversity was zero, in 1996 was as low as 0.054, but in 1997-98 it has improved (Fig. 2).

At Zerind the diversity is the most constant. 0.3 in 1994, 0.451 in 1996-97 and 0.384 in 1998.

Table 1. Quantitative data of the Oligochaeta in the River Crişul Alb in 1994, 1997, 1998.

Species	Brad			Aciuţa			Chişineu Criş			Tot. Sp. 94	Tot. Sp. 97-98
	1994	1997	1998	1994	1997	1998	1994	1997	1998		
Amphichaeta leydigii										-	+
Spercaria josinae		106								-	+
Nais behningi				20			30			+	+
N. bretscheri										+	-
N. communis	386									+	-
N. pseudoptusa										+	+
N. variabilis	214									+	-
Pristina rosea								109	58	+	+
P. bilobata	686			241	118					+	+
P. aequiseta										-	+
Uncinais uncinata	86									+	-
Limnodrilus claparedeianus	171		399	302	680	1106	40			+	+
L. hoffmeisteri	2313			845			30			+	-
L. profundicola	428			181						-	-
Isochaeta virulenta										-	+
Potamothrix isochaetus		193	204						102	-	+
P. vejdovskyi										-	+
Peloscolex velutina										-	+
P. speciosus										-	+
Rhyacodrilus falciformis										-	+
Total (ind/m^2)	4284	299	603	1589	798	1106	100	109	160	-	-
Total sp.	7	2	2	5	2	1	3	1	2	11	14

Table 2. Quantitative data of the Oligochaeta in the River Crişul Negru in 1994, 1996, 1997, 1998.

Specii	Ştei				Tinca				Zerind				Tot.	Tot.
	1994	1996	1997	1998	1994	1996	1997	1998	1994	1996	1997	1998	Sp. 94	Sp. 96-98
Nais barbata	219												+	-
N. behningi		203	803	201		351			557				+	+
N. bretscheri	619			97					10				+	+
N. communis													+	-
N. pseudoptusa													+	-
Pristina aequiseta			251			52			10	206			+	+
P. bilobata		1106	198			138					108	81	+	+
P. rosea													+	-
Vejdovskyella comata		49											+	+
Uncinais uncinata	109												+	-
Slavina appendiculata													-	+
Spercaria josinae		550				616	106	104					-	+
Branchiura sowerbyi					59		501	406					+	+
Potamothrix vejdovskyi		98				1405	486	1105		92			-	+
Isochaeta michaelseni						48	4384	2893			199	399	-	+
Limnodrilus claparedeianus	401	347		104		2991				103	96	153	+	+
L. hoffmeisteri	987								182				+	-
L. profundicola													-	+
Tubifex newaensis							198						+	+
T. tubifex	474												+	-
Eiseniella tetraedra													+	-
Total (ind/m^2)	2809	2353	1252	402	59	5601	5675	4508	759	401	403	633	-	-
Total species	6	6	3	3	1	7	5	4	4	3	3	3	16	13

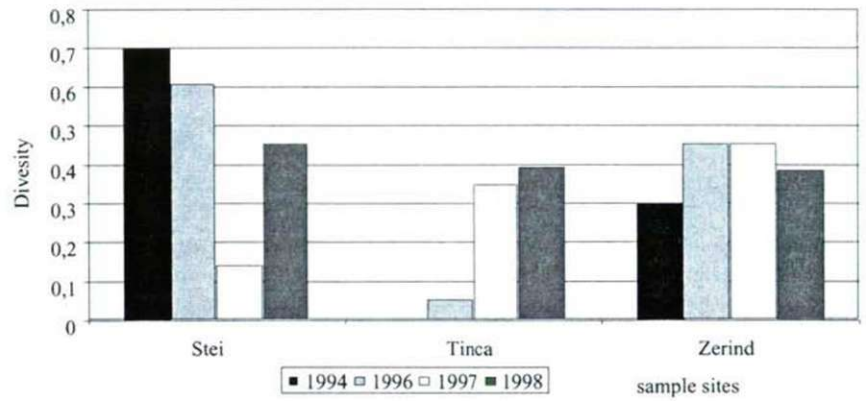

Fig.2. Comparative diversity of the oligochaeta fauna in the Crişul Negru River as a living resource in 1994, 1996-1998. (Shannon-Wiener div. Index)

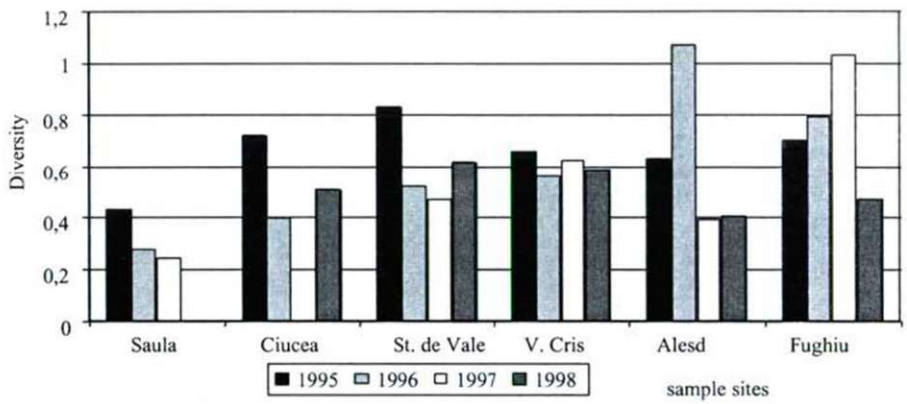

Fig. 3. Comparative diversity of the oligochaeta fauna in the Crişul Repede River as a living resource in 1995-1998. (Shannon-Wiener div. Index)

Crişul Repede River

In 1995 the number of species was higher than in the following years. In the first 5 sample sites the differences between the number of species are high, in 1995 there were found more than the double of the species than in the following years. But the situation of the density is different because we registered sites (Ciucea, Vadu Crişului, Aleşd) were the density increased between 1996-1998, although the number of species decreased.The smallest difference is at Fughiu where except 1998, when we found only 3 species in the previous years, the number of species is almost the same (between 8 and 10) (Table 3). At this sample site the density of the oligochaeta is much higher in 1996-1998 than in 1995. The total number of species found in all sampling sites along the river (8 in every year of study) was 25 in 1995 and 24 between 1996-98. The common species were 13: *Nais barbata, N. behningi, N. bretscheri, N. pseudoptusa, Vejdovskyella*

comata, Stylaria lacustris, Pristina bilobata, P. rosea, P. aequiseta, Branchiura sowebyi, Limnodrilus claparedeianus, L. hoffmeisteri, L. udekemianus.

The diversity of the oligochaeta in the four years of study varies, it is lower between 1996-98 than in 1995 (Fig. 3) at Şaula, Ciucea, Stâna de Vale, and Vadu Crişului. At Aleşd in 1996 the diversity is higher than in 1995, but in the following years it decreases. At Fughiu in 1996 and 1997 it is higher than in 1995, and in 1998 it is lower.

Discussion

In the Crişul Alb River the high density of the oligochaeta at Brad in 1994 is probably due to the organic material content and the quantity of the inorganic phosphorus which determine the biomass of the primary production, the main food source of the worms (A. Szitó, K. Mózes, 1997). The decrease of the density and the number of species in the following years is probably due to the decrease of the inorganic phosphorus quantity or a higher flow of the water which can wash away the phosphorus, the organic matter and also the worms.

At Aciuţa the number of species is lower in 1997-98, but we found the same species as in 1996, with lower densities. Here the river is cleaner than at Brad and the lower organic content does not allow the settlement of too many species.

At Chişineu-Criş we found in the three years of study different species but the same low density. This is due to the fact that in this sector the river banks are endammed and the riverbed is very uniform. Also, the muddy and sandy riverbed is moved by the current so the benthic fauna cannot consolidate here. For this reason, the species found here, in the different years are not the same and their density is low.

The existence of only five common species found in the different years of study, reflects the fact that the aquatic oligochaeta in the Crişul Alb River is not well consolidated, it varies a lot, due to the fact that the river crosses many localities which can pollute the river with organic or inorganic materials, affecting the quality of the water and the benthic communities.

On the Crişul Negru River at Ştei the quality of the water is poor due to the organic wastes eliminated from the locality in the river. This fact determines a higher density of aquatic oligochaeta which have good trophic conditions at this sample site. In 1998 the water quality seems to improve because the density of the oligochaeta drops abruptly (Table 2).

At Tinca we found great differences between the oligochaeta identified in 1994 and 1996-1998, regarding the number of species as well as the density. In 1994 was found a single species *Branchiura sowerbyi* with a low density of individuals. This species is a thermophylic and pelophylic one and it was found in almost all research period. During 1996-98 the number of the species was higher (4 to 7 species) with a higher density, fact which is probably due to the higher organic content in the river in this period which offers a good trophic base to the oligochaeta. Some of the species could be carried here from upstream by the water from the regions where the water speed is higher and can wash the substratum, especially in the periods with high flows. At Tinca the water flows slower and the oligochaeta can be deposited in the riverbed.

Table 3. Quantitative data of the Oligochaeta in the River Crişul Repede in 1995-1998.

1		Şaula				Ciucea				St.Vale			
2	Specii	95	96	97	98	95	96	97	98	95	96	97	98
3	Chaetogaster diastrophus												
4	Ch. langi		106	296									
5	Spercaria josinae						502		611		206	150	
6	Aulodrilus pigueti												
7	A. pluriseta					2							
8	Uncinais uncinata												
9	Nais barbata					4				325			
10	N. behningi						150		204	104	103	102	402
11	N. bretscheri					138				207			110
12	N. communis					274				380			
13	N. elinguis					8				147			
14	N. pardalis									484			
15	N. pseudoptusa					30				573			
16	N. variabilis												
17	Slavina appendiculata												
18	Ophidonais serpentina									70			
19	Vejdovskyella comata												
20	Stylaria lacustris												
21	Piguetiella blanci								98				96
22	Dero obtusa												
23	Pristina rosea					16		109					
24	P. bilobata					8							
25	P. aequiseta					14					51		102
26	Rhynchelmis sp.									35			
27	Stylodrilus heringianus	14											
28	Tubifex tubifex	859				6							
29	Tubifex newaensis												
30	Branchiura sowerbyi												
31	Limnodrilus claparedeianus	328	58		103		144		205		99		205
32	L. hoffmeisteri	3443		98		56						98	
33	L. profundicola	11											
34	L. udekemianus	439											
35	Psammorycrtides moravicus												
36	Ps. albicola												
37	Potamothrix vejdovskyi												
38	Eiseniella tetraedra									15			
39	Total (ind/m^2)	5094	164	394	103	556	796	109	1118	2340	459	352	915
40	Total species	6	2	2	1	11	3	1	4	10	4	3	5

1	V.Criş				Aleşd				Fughiu				Tot.	Tot.
2	95	96	97	98	95	96	97	98	95	96	97	98	Sp. 95	Sp. 96-98
3						101							-	+
4								105					-	+
5		202	294	201		196	108	191		506	608		-	+
6									7				+	-
7	13												+	-
8											95		-	+
9	7				73								+	+
10	16		795	199	119					250	204		+	+
11	312		101		1295								+	+
12	86				123				20				+	-
13	23				53								+	-
14	19				377				3				+	-
15	73		204		103								+	+
16					3								+	-
17													-	+
18	7								51				+	-
19				103					3	98		204	+	+
20					12				88				+	+
21										496	351	803	-	+
22													-	+
23					3		396	209			108	968	+	+
24	6	97	98		17				7	311	791		+	+
25			103		10					105	401		+	+
26													+	-
27													+	-
28	13				46				3	101			+	-
29										803	750		-	+
30									3				+	+
31	6			204									+	+
32		301			12	998	3402	2989	17				+	+
33													+	-
34													+	+
35		103					550	795					-	+
36							197						-	+
37													-	+
38					13						100		+	-
39	581	703	1595	707	2259	1295	4653	4289	202	2670	3480	2080		-
40	12	4	6	4	15	3	5	5	10	8	9	3	25	24

At Zerind the number of species and their density do not vary too much, but the found species were different in the studied years. The reason for this fact is the same as mentioned at Chişineu-Criş: the enbankment of the river and the moving substrate which does not allow the oligochaeta community to consolidate.

In the Crişul Negru River we found 8 common species for the two study periods, which represent half of the total species found in the river. This reflects the fact that the river has a basic structure of oligochaeta on which the associations can build up.

In the Crişul Repede River at Şaula the density and the number of species decrease between 1996-1998 as compared to 1995, but the Tubificidae species are also dominant, fact which reflects a high organic content of the water at this sample site.

At Ciucea the situation of the number of species is similar to that found at Şaula, the density increases in 1996 and 1998, but here the Naididae species are dominant, fact which reflects an improving water quality compared to the Şaula sample site.

At Stâna de Vale and Vadu Crişului the number of species decreases between 1996-98 compared to 1995, but at Vadu Crişului the density increases in the same period. At these two sample sites the dominant oligochaeta are also the Naididae. Here the water quality is relatively good, with a small organic content.

At Aleşd the number of species decreases between 1996-98 but the density is higher in 1997 and 1998 than in 1995 and 1996. Here the dominant species are also the Naididae.

At Fughiu the differences between the number of species is not so high between 1995-97, but it drops in 1998. The density is much higher between 1996-98 than in 1995. The modifications of the number of species and their density along the Crişul Repede River is due probably to the hydrological regime of the water, the great number of dammed portions which function as water reservoirs and from where the water is cleared out in the dry periods of the year to ensure the water supply for the localities along the Crişul Repede River. These modifications in the hydrological conditions can wash away a part of the oligochaeta fauna and cause the mentioned modifications.

The total number of species found in 1995 was 25 and between 1996-98 it was only 24. The common species from these years in the river are 13. This reflects the fact that the oligochaeta community along the Crişul Repede River has a basis of species around which the associations consolidate.

Conclusions

Along the Crişuri rivers we found during the mentioned study years great modifications concerning the number of species and their density. These modifications are caused by the different levels of pollution in the different years, the different hydrological regimes and the characteristics of the life cycles of each species.

The diversity of the oligochaeta is generally low, in some places equal to zero in some periods (Şaula 1998, Ciucea 1997, Tinca 1994, Aciuţa 1998, Chiţineu-Criş 1997).

The number of species along the rivers have a little variation between the years of study with the exception of the major part of the Crişul Repede River, but we found different species in different years in the same sample sites.

In the most upstream river portions the Naididae species are dominant, which reflects a better water quality than in the lower portions where the Tubificidae are dominant.

Because in the studied period we did not register major environmental modifications in the rivers we consider that it is necessary to follow the modifications of the oligochaeta fauna during several years on a long term period, to find out all the factors which contribute to the modifications of the species composition and density of the oligochaeta.

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